

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 2 of 12

Attorney's Docket No.: 09850-013001

5. (Original) The metering pump of claim 4 wherein the cylinders are pivotably connected to a housing and the adjustment mechanism comprises a screw and nut.

6. (Original) The metering pump of claim 1 wherein the first cylinder has a dimension defining an inner volume that differs from a corresponding dimension of the second cylinder.

7. (Original) The metering pump of claim 6 wherein the dimension is an inner diameter of the cylinder.

8. (Original) The metering pump of claim 1 comprising at least three cylinders.

9. (Original) The metering pump of claim 8 wherein each cylinder has a working volume that differs from the other cylinders.

10. (Original) The metering pump of claim 1 wherein the actuating mechanism comprises a transition arm coupled to a stationary support and a rotary member.

11. (Currently Amended) The metering pump of claim 10 wherein the transition arm is coupled to the stationary support by a Universal-joint.

12. (Original) The metering pump of claim 10 wherein the transition arm includes a plurality of drive arms and a plurality of joints, each drive arm being coupling to one of the cylinders by a respective joint.

13. (Original) The metering pump of claim 12 wherein the joint provides three degrees of freedom.

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 3 of 12

Attorney's Docket No.: 09850-013001

226/21

14. (Original) The metering pump of claim 13 wherein the joint provides four degrees of freedom.

15. (Original) The metering pump of claim 1 wherein the actuating mechanism is centrally located.

16. (Canceled)

17. (Currently Amended) A method of metering fluids, comprising:  
independently adjusting stroke of one piston of a plurality of pistons to adjust the volume of metered fluid, each piston being housed within a non-rotating cylinder having a fluid inlet and a metered fluid outlet, and  
selecting different cylinder diameters to adjust the volume of metered fluid.

18-22. (Canceled)

23. (Currently Amended) ~~A~~ The metering pump of claim 1, further comprising:  
a drive shaft, an the actuating mechanism being coupled to the drive shaft, and  
a plurality of piston cylinders arranged radially about the actuating mechanism and  
coupled to the actuating mechanism, a first of the cylinders having a working volume that differs  
from a second of the cylinders,  
wherein at least part of the actuating mechanism is located between the piston cylinders.

24. (Previously Presented) The metering pump of claim 23 wherein the actuating mechanism comprises a transition arm coupled to a stationary support and a rotary member.

25. (Currently Amended) The metering pump of claim 24 wherein the transition arm is coupled to the stationary support by a Universal joint.

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 4 of 12

Attorney's Docket No.: 09850-013001

26. (Previously Presented) The metering pump of claim 23 wherein the actuating mechanism is centrally located.

27. (Canceled)

28. (Currently Amended) A The metering pump of claim 1, comprising:  
an actuating mechanism, and  
a plurality of piston cylinders arranged radially about the actuating mechanism and  
coupled to the actuating mechanism, a first of the cylinders having a working volume that differs  
from a second of the cylinders;

wherein the actuating mechanism comprises a transition arm coupled to a stationary support by a Universal-joint.

✓ 29. (Currently Amended) A metering pump, comprising:  
an actuating mechanism, and  
a plurality of non-rotating, fluid-pumping piston cylinders arranged radially about the actuating mechanism and coupled to the actuating mechanism, a first of the cylinders having a working volume that differs from a second of the cylinders,  
wherein ~~an~~ a central axis of the first cylinder is spaced from a central axis of the actuating mechanism a distance that differs from a spacing of ~~an~~ a central axis of the second cylinder from the central axis of the actuating mechanism.

30. (Previously Presented) A metering pump, comprising:  
an actuating mechanism,  
a plurality of piston cylinders arranged radially about the actuating mechanism and coupled to the actuating mechanism, a first of the cylinders having a working volume that differs from a second of the cylinders, and

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 5 of 12

Attorney's Docket No.: 09850-013001

an adjustment mechanism configured to independently vary the spacing of one piston cylinder of the plurality of piston cylinders from the actuating mechanism to independently adjust the stroke of a piston in the one piston cylinder.

31. (Currently Amended) A The metering pump of claim 1, comprising:  
~~an actuating mechanism, and~~  
~~a plurality of piston cylinders arranged radially about the actuating mechanism and~~  
~~coupled to the actuating mechanism, wherein each cylinder of the plurality of cylinders has a~~  
~~working volume that differs from the other cylinders and wherein~~ at least part of the actuating  
mechanism is centrally located between the piston cylinders.

32. (Withdrawn) A method of mixing fluids, comprising:  
selecting different cylinder diameters to coarsely adjust a mix percentage of a plurality of  
fluids in a mixture, each cylinder housing a piston that pumps one of the plurality of fluids into  
the mixture; and  
adjusting the stroke of each piston in each cylinder to finely adjust the mix percentage of  
the plurality of fluids in the mixture.

33. (Currently Amended) A pump for mixing fluids, comprising:  
an actuating mechanism;  
a plurality of non-rotating piston cylinders arranged radially about the actuating  
mechanism and coupled to the actuating mechanism, each cylinder housing a piston that pumps  
one of a plurality of fluids into a mixture and each cylinder having a working volume chosen to  
coarsely adjust a mix percentage of each fluid in the mixture; and  
an adjustment mechanism configured to independently adjust the stroke of each  
piston in each cylinder to finely adjust the mix percentage of each fluid in the mixture.

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 6 of 12

Attorney's Docket No.: 09850-013001

34. (Currently Amended) The method of claim 17 further comprising wherein ~~independently adjusting stroke of one piston includes~~ independently adjusting stroke of each piston of the plurality of pistons.

35. (Currently Amended) The method metering pump of claim 27 58 wherein in at least one operating configuration the axis of rotation of the rotary member and the longitudinal axis of at least one piston are parallel

36-39. (Canceled)

40. (Currently Amended) ~~A~~ The metering pump of claim 11, comprising:  
~~an actuating mechanism including a transition arm coupled to a stationary support by a~~  
~~U joint and coupled to a rotary member, and~~  
~~a plurality of piston cylinders arranged radially about the actuating mechanism and~~  
~~coupled to the actuating mechanism, a first of the cylinders having a working volume that differs~~  
~~from a second of the cylinders,~~

wherein at least part of the actuating mechanism is located between the piston cylinders.

41. (Previously Presented) The metering pump of claim 1, wherein the first cylinder has a first inlet port and a first outlet port, the second cylinder has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

42-46. (Canceled)

47. (Previously Presented) The metering pump of claim 23, wherein a first cylinder of the plurality of piston cylinders has a first inlet port and a first outlet port, a second cylinder of the plurality of piston cylinders has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 7 of 12

Attorney's Docket No.: 09850-013001

48. (Canceled)

49. (Previously Presented) The metering pump of claim 28, wherein a first cylinder of the plurality of piston cylinders has a first inlet port and a first outlet port, a second cylinder of the plurality of piston cylinders has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

50. (Previously Presented) The metering pump of claim 29, wherein a first cylinder of the plurality of piston cylinders has a first inlet port and a first outlet port, a second cylinder of the plurality of piston cylinders has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

51. (Previously Presented) The metering pump of claim 30, wherein a first cylinder of the plurality of piston cylinders has a first inlet port and a first outlet port, a second cylinder of the plurality of piston cylinders has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

52. (Previously Presented) The metering pump of claim 31, wherein a first cylinder of the plurality of piston cylinders has a first inlet port and a first outlet port, a second cylinder of the plurality of piston cylinders has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

53. (Previously Presented) The metering pump of claim 33, wherein a first cylinder of the plurality of piston cylinders has a first inlet port and a first outlet port, a second cylinder of the plurality of piston cylinders has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 8 of 12

Attorney's Docket No.: 09850-013001

54. (Previously Presented) The metering pump of claim 24 wherein the rotary member is coupled to the drive shaft.

55. (Currently Amended) A The metering pump of claim 1 wherein the, comprising:  
an actuating mechanism ~~including~~ includes a transition arm coupled to a rotary member, the rotary member configured to rotate about an axis intersecting the rotary member, the transition arm including a drive member coupled to the rotary member off-axis of the rotary member, the drive member configured to circumscribe a circle about the axis while other portions of the transition arm are non-rotating about the axis, ~~and~~  
~~a plurality of piston cylinders arranged radially about the actuating mechanism and coupled to the actuating mechanism, a first of the cylinders having a working volume that differs from a second of the cylinders.~~

56. (Canceled)

57. (New) The metering pump of claim 55 wherein the actuating mechanism is centrally located.

58. (New) The metering pump of claim 1 wherein the actuating mechanism is coupled to a rotary member.

✓ 59. (New) A metering pump, comprising:  
an actuating mechanism, and  
a plurality of fluid-pumping piston cylinders arranged radially about the actuating mechanism and coupled to the actuating mechanism, the actuating mechanism being between the cylinders, a first of the cylinders having a working volume that differs from a second of the cylinders,

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 9 of 12

Attorney's Docket No.: 09850-013001

wherein a central axis of the first cylinder is spaced from a central axis of the actuating mechanism a distance that differs from a spacing of a central axis of the second cylinder from the central axis of the actuating mechanism.

✓ 60. (New) The metering pump of claim 59 further comprising an adjustment mechanism configured to vary the spacing of the cylinders from the actuating mechanism.

✓ 61. (New) The metering pump of claim 59 comprising at least three cylinders. ←

✓ 62. (New) The metering pump of claim 61 wherein each cylinder has a working volume that differs from the other cylinders.

✓ 63. (New) The metering pump of claim 59 wherein the actuating mechanism comprises a transition arm coupled to a stationary support by a universal-joint.

✓ 64. (New) The metering pump of claim 59 wherein the first cylinder has a first inlet port and a first outlet port, the second cylinder has a second inlet port and a second outlet port, and the first inlet port and the second inlet port are isolated from each other.

112  
✓ 65. (New) The metering pump of claim 59 wherein the actuating mechanism includes a transition arm coupled to a rotary member, the rotary member configured to rotate about an axis intersecting the rotary member, the transition arm including a drive member coupled to the rotary member off-axis of the rotary member, the drive member configured to circumscribe a circle about the axis while other portions of the transition arm are non-rotating about the axis.

— 66. (New) The metering pump of claim 29 further comprising an adjustment mechanism configured to vary the spacing of the cylinders from the actuating mechanism.



Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 10 of 12

Attorney's Docket No.: 09850-013001

- ✓ 67. (New) The metering pump of claim 29 comprising at least three cylinders.
- ✓ 68. (New) The metering pump of claim 67 wherein each cylinder has a working volume that differs from the other cylinders.
- ✓ 69. (New) The metering pump of claim 29 wherein the actuating mechanism comprises a transition arm coupled to a stationary support by a universal-joint.
- 211 ✓ 70. (New) The metering pump of claim 29 wherein the actuating mechanism includes a transition arm coupled to a rotary member, the rotary member configured to rotate about an axis intersecting the rotary member, the transition arm including a drive member coupled to the rotary member off-axis of the rotary member, the drive member configured to circumscribe a circle about the axis while other portions of the transition arm are non-rotating about the axis.
- ✓ 71. (New) The metering pump of claim 30 wherein the cylinders are pivotably connected to a housing and the adjustment mechanism comprises a screw and nut.
- ✓ 72. (New) The metering pump of claim 30 comprising at least three cylinders.
- ✓ 73. (New) The metering pump of claim 30 wherein each cylinder has a working volume that differs from the other cylinders.
- ✓ 74. (New) The metering pump of claim 30 wherein at least part of the actuating mechanism is located between the piston cylinders.
- ✓ 75. (New) The metering pump of claim 30 wherein the actuating mechanism comprises a transition arm coupled to a stationary support by a universal-joint.

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 11 of 12

Attorney's Docket No.: 09850-013001

76. (New) The metering pump of claim 30 wherein the cylinders are non-rotating.

77. (New) The metering pump of claim 30 wherein the actuating mechanism includes a transition arm coupled to a rotary member, the rotary member configured to rotate about an axis intersecting the rotary member, the transition arm including a drive member coupled to the rotary member off-axis of the rotary member, the drive member configured to circumscribe a circle about the axis while other portions of the transition arm are non-rotating about the axis.

71. (New) The metering pump of claim 33 wherein the cylinders are pivotably connected to a housing and the adjustment mechanism comprises a screw and nut.

72. (New) The metering pump of claim 33 comprising at least three cylinders.

73. (New) The metering pump of claim 33 wherein each cylinder has a working volume that differs from the other cylinders.

74. (New) The metering pump of claim 33 wherein at least part of the actuating mechanism is located between the piston cylinders.

75. (New) The metering pump of claim 33 wherein the actuating mechanism comprises a transition arm coupled to a stationary support by a universal-joint.

77. (New) The metering pump of claim 33 wherein the actuating mechanism includes a transition arm coupled to a rotary member, the rotary member configured to rotate about an axis intersecting the rotary member, the transition arm including a drive member coupled to the rotary member off-axis of the rotary member, the drive member configured to circumscribe a circle about the axis while other portions of the transition arm are non-rotating about the axis.

Applicant : Sanderson et al.  
Serial No. : 10/051,460  
Filed : January 22, 2002  
Page : 12 of 12

Attorney's Docket No.: 09850-013001

78. (New) The method of claim 17 further comprising selecting different cylinder diameters for each cylinder.

✓79. (New) The metering pump of claim 59 further comprising isolating a first fluid inlet from a second fluid inlet.

40203950.doc